CLEANING UP THE DEPARTMENT OF ENERGY'S NUCLEAR WEAPONS COMPLEX

The Congress of the United States
Congressional Budget Office

NOTES

Unless otherwise indicated, all years referred to in this report are fiscal years.

Numbers in the text and tables may not add to totals because of rounding.

Cover photo shows drums of low-level radioactive waste stored on an asphalt pad in a trench at the Hanford nuclear facility in Richland, Washington. (Photo courtesy of the Department of Energy.)

Preface

The Department of Energy faces daunting challenges as it attempts to correct the environmental problems that exist throughout its nuclear complex. As DOE's budget for its Environmental Restoration and Waste Management program has grown, so has Congressional concern about how DOE intends to carry out its cleanup plan. This study, which was requested by the Chairman of the Department of Energy Defense Nuclear Facilities Panel of the House Committee on Armed Services (now known as the Military Application of Nuclear Energy Panel), examines the key issues that bear on the potential costs of DOE's cleanup program. In keeping with the Congressional Budget Office's (CBO's) mandate to provide objective analysis, this study makes no recommendations.

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The authors would like to thank Perry Beider, Wayne Glass, Elizabeth Chambers, Douglas Elmendorf, and Kim Cawley of CBO for their valuable assistance. The study also benefited from the contributions of many people outside CBO. Paul Portney, Jonathan Gledhill, Mark Holt, Peter Johnson, and John Morrall made helpful comments on the draft. Though space constraints do not permit naming all of the DOE staff and contractors who responded to numerous requests for information, the authors would especially like to thank Eli Bronstein, Robert Muller, and Beverly Heffernan, who provided many updates to budgetary data. (The assistance of external participants implies no responsibility for the final product, which rests solely with CBO.)

Sherry Snyder edited the report, and Christian Spoor provided editorial assistance. Judith Cromwell, Gwen Coleman, and Donna Wood typed numerous drafts. Kathryn Quattrone, with the assistance of Regina Washington and Martina Wojak-Piotrow, prepared the study for publication.

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May 1994

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Summary

A half century ago, the United States initiated a massive effort, cloaked in secrecy, that produced the most powerful nuclear arsenal in the world. Fifty years later, much of the production capacity is no longer needed, but a legacy remains in the form of vast quantities of nuclear and other types of hazardous waste. As the demands for production of nuclear weapons decrease, the Department of Energy (DOE), which now manages both the production of nuclear weapons and the cleanup effort, will increasingly turn its attention to the problem of cleaning up its complex.

DOE's Cleanup Program

The nuclear complex of the Department of Energy consists of 15 major facilities or installations spread over 12 states. Today that complex holds in storage over 100 million gallons of highly radioactive waste, 66 million gallons of waste contaminated with plutonium, and even larger volumes of waste with lower levels of radioactivity. In addition, radioactive and other hazardous substances have contaminated soil and groundwater at DOE's installations. Although some of DOE's environmental problems involve conventional contaminants that are common to many cleanup tasks, the vast majority of its pollutants contain some level of radioactivity and so pose challenges unique to DOE. The department has committed itself to meeting all applicable legal requirements by the year 2019.

In 1989, DOE created the Office of Environmental Restoration and Waste Management (EM), which has primary responsibility for cleanup activities. Since its inception, the office has experienced rapid budget increases. Its budget has risen from $1.6 billion in 1989 to more than $6 billion in 1994, exceeding the funding for the production and maintenance of nuclear weapons for that year. Funding devoted to the cleanup program is projected to continue to increase, rising to more than $7 billion by 2000, based on the Administration's out-year targets.

How much the cleanup program will ultimately cost taxpayers is unknown. In 1988, DOE estimated that the cost would be between $66 billion and $110 billion, but estimates keep rising. In 1993, DOE officials suggested the cost could range from $400 billion to $1 trillion. But no one can make an estimate with any degree of confidence until the Congress and regulators clarify the ultimate goals of the program, which include reducing health and safety risks to humans and mitigating damage to the environment. The goals may also include restoring sites to make them available for other uses--industrial, commercial, residential, or recreational. Setting goals and priorities will help determine the specific steps DOE must take to achieve them, which will permit more accurate cost estimates. In turn, such estimates can help set priorities among the various cleanup options.

Factors Contributing to the Growth of the Cleanup Program

Several factors have contributed to the rapid growth of the EM program. As the need to produce nuclear

weapons has decreased, responsibility for some DOE facilities and programs for managing associated waste have been transferred from the production program to the EM program. Another factor is the increasing number of regulations that govern how DOE operates. Until the 1980s, DOE maintained that the Atomic Energy Act, which it administered, took precedence over other environmental and safety laws and regulations. Now, however, the department concedes that it must accommodate many legal constraints established outside DOE. It must comply with national laws governing environmental impact statements and cleanup plans, and it is also subject to state environmental laws and related requirements. Finally, many specific requirements are set forth in agreements between DOE, the Environmental Protection Agency, and state regulatory authorities. Many of these agreements contain schedules and timetables for the start and finish of cleanup activities at DOE's various sites.

Budget Constraints

While DOE's cleanup responsibilities have increased, the size of the budget function for national security, which includes the bulk of DOE's cleanup budget, continues to decrease in real terms in the aftermath of the Cold War. Although DOE has received most of the cleanup funds it has requested from the Congress, that situation could change. Indeed, in 1994 the Congress appropriated approximately $300 million less than DOE requested for its cleanup program. To accommodate budgets that may no longer rise as rapidly as in the past, the department may have to revise the priorities for its EM program and seek more efficient means of carrying it out.

Establishing Goals and Priorities for the Cleanup Program

Policymakers need to establish realistic goals and objectives for the cleanup effort. Returning all DOE sites to a pristine state by 2019 is clearly not realistic, given the presence of such contaminants as long-lived radioactive materials and substances that persist in groundwater.

There is general agreement that DOE should promptly eliminate imminent hazards to the public, and DOE is moving to do so. For the remainder of the program, however, the Congress and DOE need to decide what to do and when to do it. They must grapple with the question of whether DOE should attempt to minimize all risks to human health and the environment, regardless of cost, or whether some amount of risk is acceptable. Moreover, they must recognize that eliminating some risks will inevitably increase others. For instance, transporting hazardous wastes for disposal entails the risk of a catastrophic accident. Policymakers also need to determine the ultimate use of each site and how quickly to restore it to an alternative use.

Understanding Risks

To make informed decisions, DOE will need better information about the risks posed by the hazardous substances within its complex. Polls suggest that the public perceives hazardous waste sites to be extremely dangerous. The negative publicity associated with Love Canal and Times Beach, for example, help explain that concern. But two recent reports published by the Environmental Protection Agency (EPA) suggest that hazardous waste sites rank considerably lower in risk than many other environmental problems. In one report, experts within EPA attempted to assess the relative risks of a number of environmental problems, such as hazardous waste sites, air pollutants, discharges of contaminants into drinking water, and exposure of workers to chemicals. These technical and policy experts ranked the problems in terms of four categories of risk: cancer risks, noncancer health risks, ecological damage, and risk to economic welfare. In none of the four categories did hazardous waste sites such as those within the DOE complex rank among the worst problems. The second report, by EPA's Science Advisory Board, identified some important shortcomings in the first report but did not dispute its relative rankings of health risks.

These studies raise questions about how much of the limited public funds available for environ-

mental cleanup should be devoted to hazardous waste sites such as DOE's. Both of the EPA studies emphasize, however, that their results are not conclusive, because information about risks is limited. Better information is clearly needed so that policymakers can make informed decisions about how to allocate resources for cleanup activities. For example, it would be helpful to have more definitive studies regarding the long-term effects of substances found at DOE installations on the health of the public and the environment. DOE also needs to have a better idea of which hazardous substances are found at its installations and whether or not they are migrating off-site. To this end, DOE has initiated an effort to evaluate the information available about risks to human health and the environment and to fill the gaps in knowledge in order to develop a comprehensive strategy for reducing risks. The National Academy of Sciences is assisting with this effort.

Only after such information is available can DOE show that it is making the appropriate choices based on scientific evidence and so continue to win both Congressional and public support for its cleanup program. This problem is not unique to DOE; the Environmental Protection Agency and the Department of Defense need similar information, and any efforts to gather that information should therefore be collaborative.

Estimating Costs

To establish priorities among cleanup projects by comparing benefits and costs, DOE must have reliable estimates of the cost of those efforts. The accuracy of such estimates depends, however, on understanding the difficulty of cleanup efforts, and cleaning up some DOE sites involves highly complex problems with which DOE has little previous experience.

The department's ability to estimate costs should improve as it gains more information concerning the extent of the cleanup problem it faces. As DOE performs more assessments of the contaminants at its installations, it will have a better idea of the scope and seriousness of the cleanup task. Also, as DOE gains more experience with initiating and completing specific tasks associated with the cleanup, it will have more cost data on which to base subsequent cost analyses. Finally, DOE has undertaken some initiatives to improve its ability to estimate costs. They include a benchmarking initiative to identify causes of cost growth in DOE cleanup projects, and a performance tracking system designed to monitor the cost of projects over time.

Weighing Benefits and Costs

With more information about costs and risks, DOE can decide how to allocate funds among the various cleanup tasks. For each site requiring cleanup, DOE can employ benefit-cost analysis to help determine whether remediation is needed immediately, can be delayed, or can be avoided. The analysis should look at several factors: the cost; the benefit in terms of reduced risk to workers, the public, and the environment; and alternative uses of land and facilities that are not currently available to the public. The department could thus identify and proceed with those tasks that, for each dollar spent, provide the greatest benefit in terms of these criteria.

The Hanford Example. In late 1992, DOE released an analysis of the alternatives for disposing of eight surplus reactors at the Hanford site in Washington State. That analysis is subject to many substantial uncertainties about costs and risks, but it illustrates the effects of choices related to the cleanup program.

The department considered several options: maintaining the reactors in place indefinitely and monitoring them to ensure safety; removing them immediately for disposal at another Hanford location; and removing them to the disposal location after 75 years. It also considered whether to move the reactor blocks intact or to dismantle them first.

DOE anticipated that the cost of removing the reactors would be about the same regardless of whether it was done now or many years later. In the time leading up to removal, DOE would incur maintenance costs, but they would be relatively small. When future costs are discounted, however, the savings from delaying removal of the reactors are substantial.

How delay would affect risks is somewhat more complicated. Removing the reactors immediately would entail additional exposure of workers to higher levels of radioactive material; delaying removal would lower that risk by allowing some of the radioactive material to decay. Leaving the reactors in place indefinitely, however, could expose the population to the potential risks of radioactive contamination. But even if the buildings fell into disrepair or were abandoned, DOE estimated that just 20 additional cancer deaths would result over a period of 10,000 years. To put that figure in perspective, an estimated 400,000 people will die from cancer in 1994 in the United States. Weighing all these factors, DOE opted for one-piece removal of the reactors after a period of 75 years.

Similar Choices Elsewhere. Benefit-cost analyses are not available for most DOE cleanup sites. In many cases, DOE does not yet know the nature and extent of contamination at its facilities, nor does it have sufficient information to make reliable projections of risks or costs. Nonetheless, the type of analysis performed for the Hanford reactors is a useful tool for establishing priorities among the department's cleanup tasks.

Involving Citizens in Setting Priorities

Weighing the benefits and costs of options for cleaning up the DOE nuclear complex requires the involvement of citizens affected by the cleanup, including taxpayers, workers at the facilities, neighbors whose environment is affected, and concerned members of the public at large. They can help evaluate the benefits of various cleanup options by indicating how much they value them. Their preferences about risks and land use are key factors in making trade-offs. For instance, some communities may consider it more important to clean up a facility to a standard acceptable for industrial use--and make it available for manufacturing jobs--than to remove every trace of contamination. Others may place greater value on restoring the environment to its pristine condition. Incorporating such preferences into a benefit-cost analysis can guide decisions about setting priorities and determining the level of cleanup to be done.

DOE has stepped up efforts to increase public involvement in establishing cleanup policies. It is participating in an endeavor known as the Keystone process that attempts to improve communication between citizens and the federal agencies responsible for cleaning up hazardous waste sites. Among other things, this effort provides a forum for discussing priorities under constrained budgets.

Improving the Efficiency of DOE's Cleanup Program

While DOE gathers information and performs the analyses necessary to set priorities, it must also continue to manage its ongoing cleanup efforts. Several policy changes might make those efforts more efficient.

Place Greater Emphasis on Technology Development

Current methods of cleaning up contaminants, which usually involve digging up soil or pumping out water, are time consuming and costly, particularly for pollutants that have found their way into the groundwater. To develop techniques for characterizing and cleaning up sites more quickly and cheaply, DOE established the Technology Development program. In its budget request for fiscal year 1995, DOE has allocated 7 percent--$426 million--to that effort.

It may be appropriate, however, to invest even more funds in efforts to develop cheaper means of cleanup. DOE should add funds only for promising technology programs--those for which the present value of the cost savings and other benefits associated with the new technology exceed the cost to develop it. DOE and other organizations have identified some programs that may meet this test. Candidates include research into methods to clean up heavy metals and techniques for removing from the soil or groundwater those dense organic compounds that are not soluble in water.

New technologies may be able to make the cleanup effort cheaper in the long run. DOE claims that using new rather than current technologies could reduce the costs of some cleanup activities by as much as 80 percent. During the entire cleanup process, savings for the whole complex could approach $100 billion from a total cost that could be as high as $1 trillion. These estimates are, of course, subject to great uncertainty, but their size suggests that new technologies could have major effects on costs.

How much additional funding for technology development might be appropriate? A definitive answer would require a detailed analysis of candidate projects, which is beyond the scope of this study. But DOE and the Congress have both established 10 percent of the total cleanup budget as the goal for funding technology development. To meet that goal at the budget levels proposed by the Administration, DOE would have to add $200 million to its funding for technology development in 1995 and increasing amounts each year, with $250 million more needed in 2000. Since many of DOE's cleanup problems are similar to problems confronted by the Environmental Protection Agency and the Department of Defense, some of the additional funds might be directed to agencies other than DOE.

Regardless of which agency controls the money, the personnel to carry out added development efforts could come from a variety of places, including DOE's national laboratories and other research organizations whose defense funding is declining. Any added funds provided under this option, however, should be spent on research. Of the funds requested for technology development for 1995, about 40 percent are earmarked for programs not directly involved in research and development. If development funds are increased, the Congress could direct that all added funds be spent only on promising projects for technology development rather than on increases in administrative or support costs.

Before adding funds for technology development, the Congress may also want to direct that DOE implement a new management system to improve tracking of the costs and schedules of cleanup projects. The new system might be patterned after one now in place in the Department of Defense to track major weapons programs. For each major weapon system, the Defense Department's system establishes four milestones, each with its own costs and deadlines. Periodic reports compare progress against those goals. DOE could establish a similar system for major cleanup projects. Its milestones might start with the designation of a new cleanup site and extend until remedial work begins.

Delay Technically Difficult Characterizations and Remediations

While DOE develops new technologies to perform cleanup tasks more cheaply, the department could delay projects that are costly and time consuming to accomplish with current technology. Delaying these projects would save money in the short term and, if more efficient technology became available, could also reduce long-term costs.

Through a detailed analysis of the Environmental Restoration program's five-year plans, the Congressional Budget Office (CBO) determined that DOE could spend as much as 30 percent of its budget, on average, for environmental restoration activities over the next six years on projects that may be difficult to accomplish with current technology. These projects include characterizing very large sites or buried waste, cleaning up contaminated groundwater, remediating soil contaminated with radioactive substances or heavy metals, and decontaminating and decommissioning surplus buildings.

Delaying these technically difficult projects until more efficient technologies are available could reduce costs substantially, but CBO cannot examine each of these projects in detail to determine which can be performed at reasonable cost with today's technology. To illustrate the budgetary effect of delaying some projects, CBO examined the impact of reducing funding for all of the difficult projects by 50 percent over the next six years. The resulting savings would increase from $270 million in 1995 to $300 million in 2000. The savings could be returned to the Treasury, or they could be used to offset the added cost of increased investment in technology development.

DOE is proceeding with some of these difficult tasks, even in the absence of techniques to accomplish them efficiently, because it is bound by many agreements concerning the conduct of its cleanup program. Most of these agreements contain schedules and deadlines that determine when DOE must begin cleaning up certain sites. Delaying some projects, as envisioned in this option, would result in the breach of some of these agreements. But many agreements were signed in the early stages of the cleanup, before DOE knew the extent and type of contamination it faced. The Environmental Protection Agency, the states, and other parties to the agreements therefore might be amenable to renegotiating them if they felt that DOE was making a good-faith effort to find better ways to address mutual problems. Indeed, a recent renegotiation of the agreement governing cleanup of Hanford delayed treatment of highly radioactive waste stored in tanks by 10 years. DOE conceded that it could not meet the deadlines established in the original 1989 agreement. Through renegotiation with the EPA and state regulators, DOE established a new set of priorities and deadlines acceptable to all parties to the agreement.

Reduce Funding for Administration, Support, and Management

DOE may also need to improve the efficiency of its cleanup efforts. Since 1989, the department's Office of Environmental Restoration and Waste Management has received about $23 billion from the Congress to spend on the cleanup program. DOE has been severely criticized because of the small amount of visible cleanup that has been accomplished. Some of the slow start reflects the difficulty associated with beginning a new operation and the need to devote substantial sums to assess the nature and extent of cleanup problems. But DOE may also be devoting too much of its budget to administration and support, thus limiting the funds available for actual cleanup work.

Several reviews of DOE's costs for cleanup activities have concluded that EM devotes a large proportion of its funds to administrative and support functions. Three reviews, one by the Army Corps of Engineers and two performed under contract to DOE, have found that contractors charged the EM program project overhead rates of 20 percent to 28 percent. These rates were higher than those charged to private industry or other government agencies--in some cases by as much as a factor of 4 and 2, respectively. CBO and the Corps also found that roughly 20 percent more of EM's funds were being used to provide programwide support (such as program direction) and installationwide activities (such as security and utilities). All told, at least 40 percent of EM's funds are devoted to administrative and support activities, a level that many reviewers have considered excessive.

One of the analyses requested by DOE recommended a 7 percent reduction in the EM budget to reduce spending for project overhead, and the Corps recommended a 25 percent overall cut. If administrative costs were cut by 25 percent, the total EM budget would be reduced by 10 percent, a reduction that is toward the lower end of the range recommended by the two reviews. A reduction of this magnitude would yield savings of $630 million in 1995. Annual savings would increase to $710 million in 2000, based on the Administration's out-year targets for EM spending. The funds freed up by reducing funds devoted to administration and support could be used either to reduce the deficit or to accelerate cleanup activities.

Various studies and the Assistant Secretary for EM, Thomas Grumbly, have suggested ways to achieve such savings. One suggestion is to increase the number of DOE personnel in order to provide better oversight of DOE's large number of contractors. In the EM program alone, more than 49,000 contractor personnel are engaged in cleanup, overseen by fewer than 1,800 DOE personnel. Grumbly has proposed adding 400 DOE personnel to monitor contractors and perform some functions that are contracted out but would be more appropriately performed by government staff. He predicted that increased oversight would save $360 million in 1995.

Another means of reducing administrative spending, particularly for contractor overhead, is through contract reform. Such reform would involve changes in DOE's contracts with the firms that manage its installations. Particularly with re-

spect to contracts for environmental work, Grumbly recommends limiting the time period covered by the contracts, issuing separate environmental contracts at those installations where production is ongoing, and making individual contracts for some functions such as security or road maintenance. Grumbly is also actively pursuing this approach and predicts savings of 10 percent to 20 percent in EM spending on contracts--which represents the vast majority of EM spending--over the next four years as a result of increased oversight and contract reform combined.

Safely Maintain DOE's Surplus Facilities

The end of the Cold War and the restrictions on strategic arms that have resulted from international treaties have made much of DOE's nuclear weapons complex unnecessary. DOE could declare as many as 7,000 of its facilities surplus in the next 30 years, leading to their eventual decontamination and decommissioning. In the meantime, the EM program is responsible for the security and maintenance of an increasing number of surplus facilities.

In a recent report, the General Accounting Office concluded that the EM program faces problems concerning maintenance, safety, and costs for the disposition of its surplus facilities. Since maintaining inactive facilities is not a high priority among EM's tasks, DOE's inactive facilities are deteriorating physically. Repair projects for surplus buildings are often deferred in favor of higher-priority work elsewhere. As a consequence, conditions at such buildings have violated regulations established by DOE and the Occupational Safety and Health Administration and have resulted in accidents among workers.

Furthermore, DOE has engaged in some practices that can increase the cost and dangers associated with cleaning up inactive facilities. Incomplete or substandard work performed during the shutdown process can lead to unanticipated problems or accidents during subsequent decontamination and decommissioning. Inadequate shutdown procedures can also affect the cost of cleanup projects. For example, because equipment was not cleaned when the plutonium fuel facility at Savannah River was put on standby in 1983, it is now so badly deteriorated that it can no longer be used to remove the plutonium that remains in the facility. As a result, DOE has estimated that an additional $115 million will be needed to decontaminate and decommission the facility. Had the facility initially been cleaned adequately, subsequent higher cleanup costs could have been avoided.

In general, the cost to maintain surplus facilities awaiting cleanup is substantial and could grow because of problems of the sort just noted. Increasing near-term funding designed to attain safe shutdown status at surplus facilities, thereby reducing annual security and maintenance costs, could produce long-term savings in the DOE budget.

Conclusion

DOE's cleanup program must address a problem created and, for the most part, ignored over the past 50 years. It must do so during a period in which funding for all federal programs, including environmental cleanup, is becoming increasingly tight. Better understanding of risks and costs, brought together by benefit-cost analyses, would be the best means of establishing priorities for allocating scarce cleanup funds. DOE may also be able to improve the efficiency of its cleanup efforts by policies such as investing more heavily in technology development, delaying technically difficult projects, and cutting overhead costs. New management systems may also be necessary to permit DOE and the Congress to track the performance of cleanup projects.